

***Vesiculophora diversiseptata* gen. & sp. nov. and *Anapleurothecium clavatum* & *Podosporium simile* spp. nov. from the Brazilian Amazon**

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ABSTRACT—Three asexual fungi are described and illustrated from the Brazilian Amazon: *Vesiculophora diversiseptata* as a new genus and species; and *Anapleurothecium clavatum* and *Podosporium simile* as new species. *Vesiculophora diversiseptata* is characterized by its conidiophores becoming scorpioid after successive subacroauxic extensions and monoblastic conidiogenous cells that produce heteroseptate, brown phragmoconidia; *A. clavatum* is distinguished by its ellipsoidal to clavate, 3-euseptate, brown conidia; and *P. simile* is characterized by its synnematosus conidiomata with monotretic conidiogenous cells and brown, 3–11-euseptate, mainly obclavate, verrucose conidia. Additionally, *Pleurothecium leptospermi* is transferred to *Anapleurothecium*.

KEY WORDS—hyphomycetes, saprobes, taxonomy, tropical fungi

Introduction

The fungal diversity in the Brazilian Amazon remains underestimated, especially for microfungi. Taxonomic studies are scarce and concentrated in a few areas of this biome (Hernández-Gutiérrez 2013, Barbosa & al. 2017, Monteiro & al. 2018, 2019). However, mycological surveys in Amazon conservation units continue to contribute to an increasing number of recorded species (Barbosa & al. 2017, Monteiro & al. 2017, 2019), while collections in urbanized areas have also revealed many additions to Brazilian fungi in recent years (Monteiro & al. 2017, Santos & al. 2018, Barbosa & al. 2021).

During our ongoing mycological surveys of conidial fungi on decaying leaf litter from the Brazilian Amazon forest, we collected three interesting species. The conidiogenesis and conidial features clearly place two of these fungi in *Anapleurothecium* (Hernández-Restrepo & al. 2017) and *Podosporium* (Wang & al. 2016), while the third is proposed as a new genus, *Vesiculophora diversiseptata*. All specimens are distinct from previously described taxa and are described here as new.

Materials & methods

Collections were made in Serra do Navio (Serra do Navio, Amapá state) (0.9121°S 51.9958°W), Floresta Nacional de Caxiuanã (Melgaço, Pará state) (1.7083°S 51.5292°W), and Campus de Pesquisa do Museu Paraense Emílio Goeldi (Belém, Pará state) (1.4511°S 48.4444°W). Samples of decaying leaf litter were placed in paper bags and taken to the laboratory at Museu Paraense Emílio Goeldi for processing following procedures outlined by Castañeda-Ruiz & al. (2016). Semipermanent and permanent slides were prepared in PVL resin (polyvinyl alcohol, lactic acid, and phenol) and lactoglycerol (lactic acid and glycerol). Reproductive structures were measured at a magnification of $\times 1000$ and photographed using a Leica DM6 B microscope equipped with a digital camera. The holotypes and additional materials were deposited in the Herbario João Murça Pires (MG), Belém, Pará, Brazil. Several attempts to isolate these species onto agar media were unsuccessful.

Taxonomy

Vesiculophora J.S. Monteiro & R.F. Castañeda, **gen. nov.**

IF 558008

Differs from anamorphic *Ascotricha* by its conidiophores with unilateral extensions and its phragmosporous conidia; and from *Sporidesmiella* by its conidiophores with unilateral extensions just below the apical vesicles and its monoblastic conidiogenous cells.

TYPE SPECIES: *Vesiculophora diversiseptata* J.S. Monteiro & R.F. Castañeda

ETYMOLOGY: Latin *Vesiculophora*, referring to the presence of vesicles on the conidiophores.

COLONIES on the natural substratum effuse, brown or dark brown. MYCELIUM partly superficial and partly immersed. CONIDIOPHORES macronematous, mononematous, branched, with unilateral and apical vesicles, septate, smooth, brown or dark brown. CONIDIOGENOUS CELLS monoblastic, integrated, mostly intercalary, determinate, cylindrical, conidiogenous loci flattened. Conidial secession schizolytic. CONIDIA solitary, pleurogenous, obovoid, ellipsoidal or clavate, brown, dark brown near the base, phragmosporous, heteroseptate, 1-euseptate at base, distoseptate at the rest of body.

Vesiculophora diversiseptata J.S. Monteiro & R.F. Castañeda, sp. nov.

FIG. 1

IF 558009

Differs from anamorphic *Ascotricha* spp. by its conidiophores with unilateral scorpioid extensions and its heteroseptate conidia; and from *Sporidesmiella* spp. by its conidiophores with scorpioid, unilateral sympodial extensions just below the apical vesicles and its monoblastic conidiogenous cells.

TYPE: Brazil, Pará, Melgaço, Floresta Nacional de Caxiuanã, Estação Científica Ferreira Penna, Parcel B ESECAFLOR, on decaying wood of an unidentified dicotyledonous plant, 16.XI.2019, coll. J.S. Monteiro (Holotype, MG 237208).

ETYMOLOGY: Latin, *diversi*-, meaning in different ways, diverse, contrary; *septata*, referring to the septa.

SAPROBIC on decaying wood. COLONIES on the natural substratum effuse, hairy, scattered, brown or dark brown. MYCELIUM partly superficial and partly immersed. Hyphae branched, septate, smooth, pale brown, 2–2.5 μm wide. CONIDIOPHORES macronematous, mononematous, erect, straight or slightly flexuous, cylindrical toward the base, unilateral, scorpioid branched toward the apex, with 1–4-vesicles; vesicles conical, rounded at the tip, 3–4 $\times$ 3–4 μm , produced after successive subacroauxic lateral extensions combined with enteroblastic percurrent regenerations; 7–9-septate, smooth, brown or dark brown at the base, paler toward the apex, 180–240 $\times$ 5.5–6 μm . CONIDIOGENOUS CELLS monoblastic, integrated, cylindrical, becoming mostly intercalary after successive subacroauxic lateral and enteroblastic percurrent regenerations of the conidiophores, smooth, mid brown, 15–18.5(–29) $\times$ 4.5–6 μm . Conidiogenous loci flattened, pale brown. Conidial secession schizolytic. CONIDIA solitary, pleurogenous, broad obovoid, ellipsoidal or clavate, smooth, golden brown to brown, 31.5–39 $\times$ 11–14.5 μm (av. = 36.5 $\times$ 12.7 μm , n = 25), brown, basal cell conical, slightly darker than other conidial cells, rounded at the apex, phragmosporous, heteroseptate,



FIG. 1. *Vesiculophora diversiseptata* (holotype, MG 237208). A–G. Conidia; H–K. Conidiophores; L, N. Conidia and conidiogenous cells; M, O. Conidiogenous cells and apical vesicles. Scale bars: A–G, L–O = 20 µm; H–K = 50 µm.

1-euseptate at base, (3–)5(–6)-distoseptate toward the apex. SEXUAL MORPH undetermined.

COMMENTS—*Vesiculophora* morphologically resembles anamorphic *Ascotricha* Berk. species (Berkeley 1838, Li & Zhao 2018) because of its unilateral branched

conidiophores and presence of vesiculate extensions. However, *Ascotrisha* species have polyblastic, sympodial, denticulate conidiogenous cells and amero-sporous conidia with rhexolytic or schizolytic conidial secession (Seifert & al. 2011, Li & Zhao 2018). *Ascotrisha rugispora* (Okane & al.) D.W. Li & G.H. Zhao resembles *Vesiculophora* in the presence of vesicles on conidiophores but is distinguished by the short, clavate, hyaline remaining branches and polyblastic, discrete, curved conidiogenous cells with conspicuous scars that produce rugose, amero-sporous conidia (Okane & al. 2001, Seifert & al. 2011). *Sporidesmiella* P.M. Kirk, which has distoseptate conidia similar to *Vesiculophora*, is distinguished by terminal, indeterminate conidiogenous cells with enteroblastic percurrent extensions (Kirk 1982, Ma & al. 2012).

Vesiculophora has a particular growth of conidiophores with subacroauxic lateral extensions and monoblastic conidial production combined with the enteroblastic percurrent regenerations in the conidiogenous loci, after conidial secession, these features separate it from other hyphomycetous genera described in Seifert & al. (2011).

***Anapleurothecium clavatum* J.S. Monteiro & R.F. Castañeda, sp. nov.**

FIG. 2

IF 557977

Differs from *Anapleurothecium botulisporum* by its clavate to ellipsoidal and longer conidia.

TYPE: Brazil, Amapá, Serra do Navio, Serra do Navio, Mirante da serra, Mina desativada C3, on decaying wood of an unidentified dicotyledonous plant, 10.I.2017, coll. F.J. Rodrigues & W.K.S. Xavier (Holotype, MG 228012).

ETYMOLOGY: Latin, *clavatum*, referring to the clavate conidial shape.

SAPROBIC on decaying wood. COLONIES on the natural substratum effuse, hairy, scattered, brown. MYCELIUM superficial and immersed, hyphae branched, septate, smooth, pale brown, 2–2.5 µm wide. CONIDIOPHORES macronematous, mononematous, erect, straight or slightly flexuous, cylindrical, unbranched, 2–6-septate, smooth, brown at the base, paler toward the apex, 43–75 × 4–6 µm. CONIDIOGENOUS CELLS polyblastic, integrated, terminal or intercalary, sympodial, cylindrical, denticulate, smooth, mid brown, 18–32 × 3–4 µm; denticles conspicuous, cylindrical, truncate at the apex, 2.5–4 × 1–1.5 µm. Conidial secession schizolytic. CONIDIA solitary, acropleurogenous, 3-euseptate, ellipsoidal to clavate, straight or slightly curved, rounded at the apex, smooth, brown, 20–26.5 × 6–7 µm (av. = 23.1 × 6.2 µm, n = 20), often with basal cell conical, pale brown, 4–4.5 µm wide. SEXUAL MORPH undetermined.

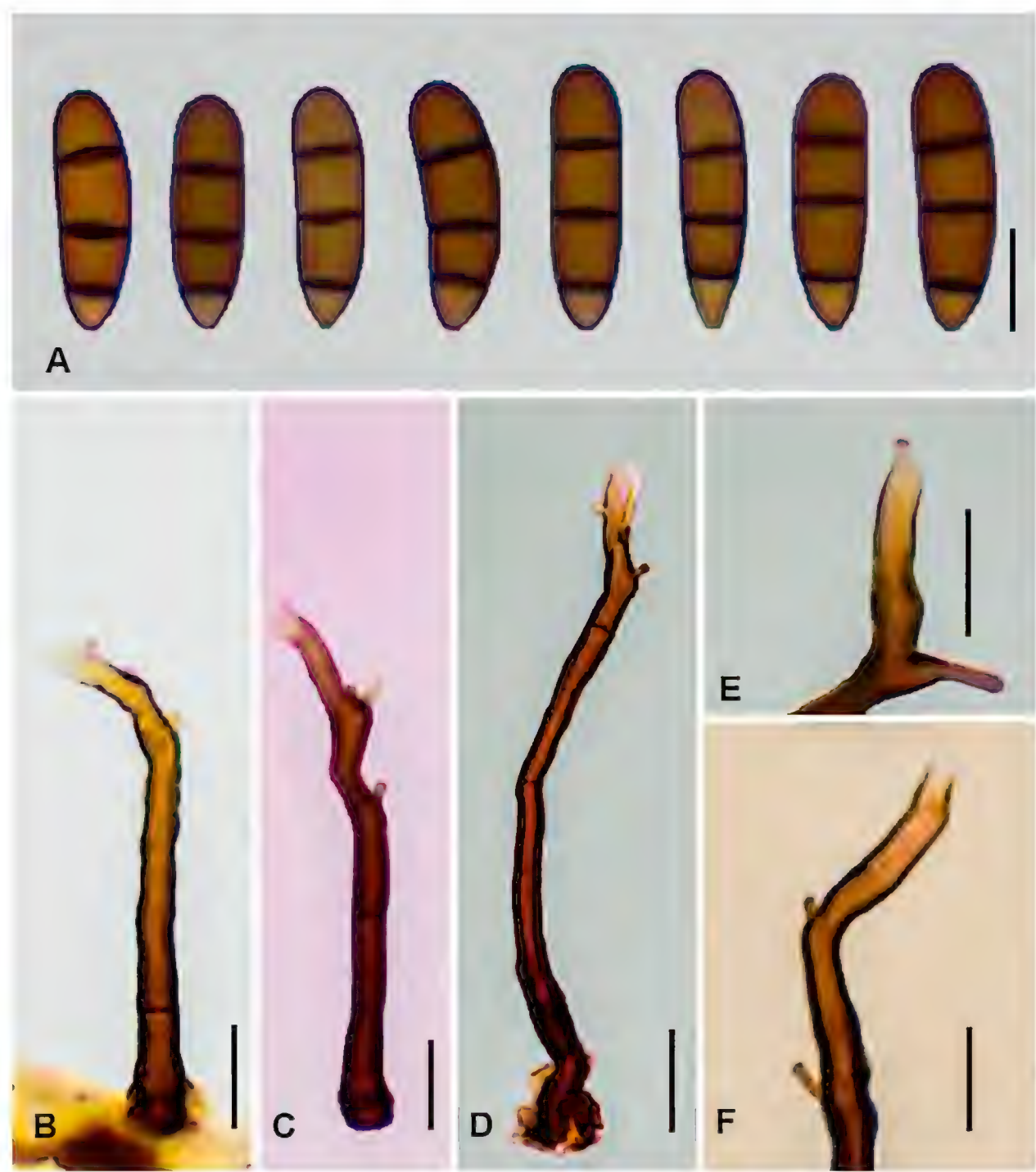


FIG. 2. *Anapleurothecium clavatum* (holotype, MG 228012). A. Conidia; B–D. Conidiophores; E–F. Conidiogenous cells. Scale bars: 10 μm .

COMMENTS—*Anapleurothecium* Hern.-Restr. & al. was proposed by Hernández-Restrepo & al. (2017) with *A. botulisporum* Hern.-Restr. & al. as its type species. It is characterized by macronematous, mononematous conidiophores with polyblastic, sympodial, denticulate conidiogenous cells that produce 3-euseptate, smooth, brown conidia with pale brown basal cells (Hernández-Restrepo & al. 2017, Qiu & al. 2020). The type species is distinguished from *A. clavatum* by longer conidiophores ($74\text{--}185 \times 5\text{--}6 \mu\text{m}$) and conidiogenous

cells ($10\text{--}47 \times 4\text{--}7 \mu\text{m}$). Furthermore, *A. clavatum* has ellipsoidal to clavate conidia, while in *A. botulisporum* the conidia are botuliform to cylindrical and shorter ($15\text{--}21 \times 6\text{--}8.5 \mu\text{m}$).

Pleurothecium leptospermi has unbranched conidiophores, with denticulate conidiogenous cells producing fusiform, 3-euseptate, versicolored, darkly pigmented conidia measuring $15\text{--}18 \times 4\text{--}5 \mu\text{m}$ (Cooper 2005). Although lacking typical recurved conidiogenous cells, *P. leptospermi* was originally assigned to *Pleurothecium* Höhn., but the species is clearly congeneric with *Anapleurothecium*, and is proposed here as a new combination.

***Anapleurothecium leptospermi* (J.A. Cooper) J.S. Monteiro & R.F. Castañeda, comb. nov.**

IF 557979

≡ *Pleurothecium leptospermi* J.A. Cooper, New Zealand

Journal of Botany 43(1): 334 (2005).

Key to *Anapleurothecium* species

1. Conidia with basal and apical cells pale brown,
fusiform to slightly clavate, $15\text{--}18 \times 4\text{--}5 \mu\text{m}$ *A. leptospermi*
1. Conidia with only basal cell pale brown, other shapes 2
2. Conidia botuliform to cylindrical, $15\text{--}21 \times 6\text{--}8.5 \mu\text{m}$ *A. botulisporum*
2. Conidia ellipsoidal to clavate, $20\text{--}26.5 \times 5\text{--}7 \mu\text{m}$ *A. clavatum*

***Podosporium simile* J.S. Monteiro & R.F. Castañeda, sp. nov.**

FIG. 3

IF 557978

Differs from *Podosporium nilgirensis* by its rostrate, 3–11-euseptate, longer conidia.

TYPE: Brazil, Pará, Belém, Campus de Pesquisa do Museu Paraense Emílio Goeldi, secondary forest fragment next to the side of Building Botany Coordination, on decaying culm of *Bambusa* sp. (*Poaceae*), 07.VIII.2018, coll. J.S. Monteiro (Holotype, MG 237213).

ETYMOLOGY: Latin, *simile*, referring to the morphological similarity to *Podosporium nilgirensis*.

SAPROBIC on decaying bamboo culm. COLONIES on the natural substratum effuse, scattered, brown to dark brown. MYCELIUM mostly immersed, composed of septate, smooth to roughened, pale brown to brown, branched hyphae. CONIDIOMATA synnematal erect, straight or slightly flexuous, solitary or in groups of 2–3, simple, cylindrical, dark brown to black, $360\text{--}790 \mu\text{m}$ long, $30\text{--}65 \mu\text{m}$ at the base of the stalk, $\leq 110 \mu\text{m}$ wide at the apical region. CONIDIOPHORES macronematous, erect, septate, unbranched, cylindrical, verrucose, brown, $2\text{--}2.5 \mu\text{m}$ wide, diverging terminally. CONIDIOGENOUS

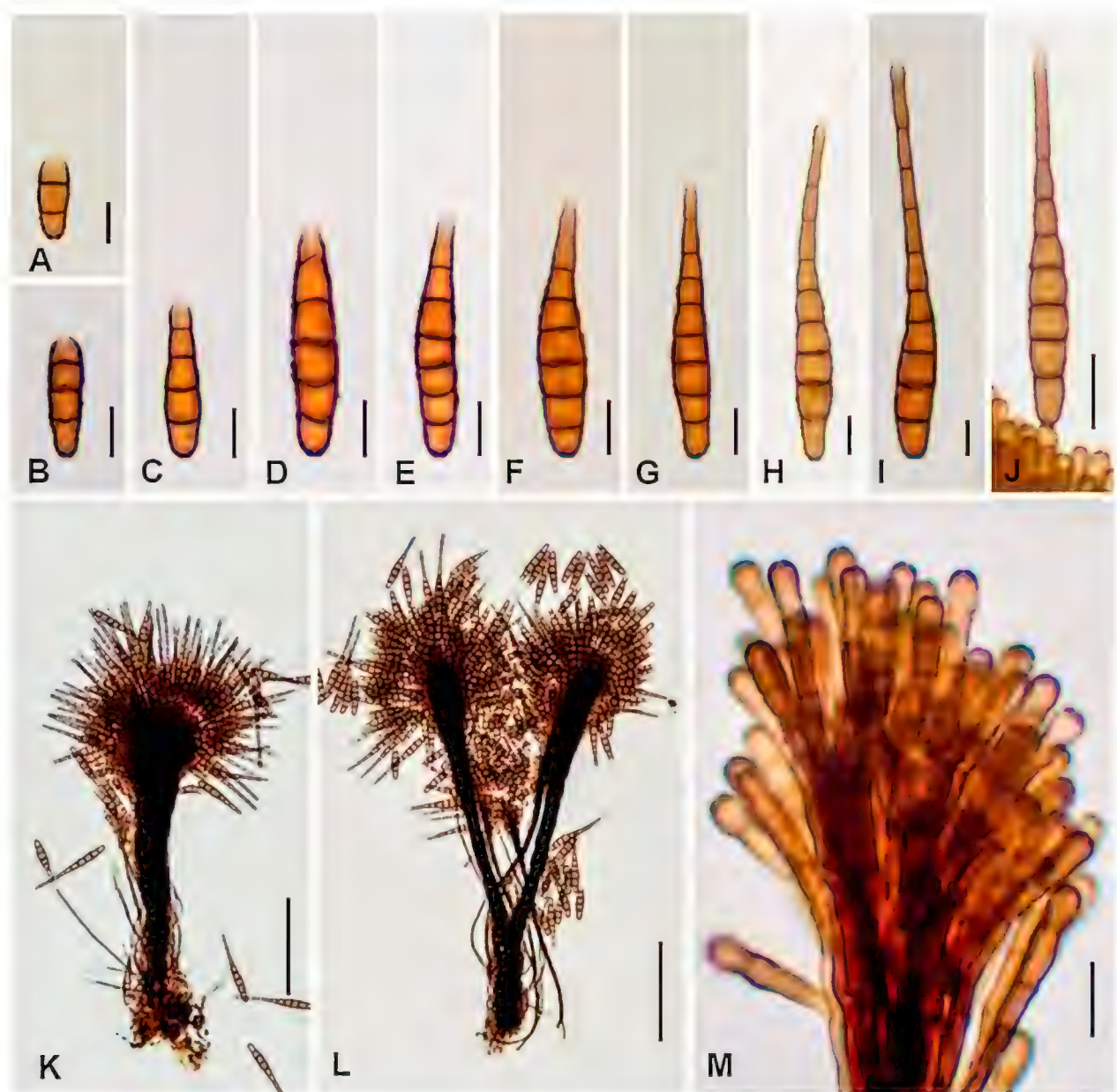


FIG. 3. *Podosporium simile* (holotype, MG 237213). A–I. Conidia; J. Conidiogenous cells and conidium; K–L. Synnemata; M. Details of conidiogenous cells. Scale bars: A–J, M = 10 µm, K–L = 100 µm.

CELLS enteroblastic, monotretic, integrated, terminal, determinate, cylindrical to clavate, verrucose, pale brown, $7.5\text{--}12.5 \times 3.5\text{--}5\text{ }\mu\text{m}$, with dark scar and conspicuous pore at the apex. Conidial secession schizolytic. CONIDIA acrogenous, solitary, obclavate, sometimes rostrate, straight, 3–11-euseptate, verrucose, brown, paler toward the apex, $25\text{--}100 \times 6\text{--}9\text{ }\mu\text{m}$ (av. = $55 \times 7.2\text{ }\mu\text{m}$, $n = 20$); apical cell rounded, subhyaline to pale brown; basal cell truncate, with a depressed hilum, $2\text{--}2.5\text{ }\mu\text{m}$ wide. SEXUAL MORPH undetermined.

COMMENTS—*Podosporium* Schwein. was established by Schweinitz (1832) and lectotypified with *P. rigidum* by Ellis (1971). The genus is characterized

by dark brown to black cylindrical synnemata, branched or unbranched conidiophores with monotretic, percurrent conidiogenous cells that produce acrogenous, multiseptate, obclavate, smooth or ornamented conidia (Ellis 1971, Zhang & al. 2011). Seifert & al. (2011) accepted only nine species in *Podosporium*: *P. bacilliforme* J.Y. Wang & al. (Wang & al. 2016), *P. cyclocaryae* Y.D. Zhang & X.G. Zhang (Zhang & al. 2011), *P. biseptatum* Joanne E. Taylor & al. (Taylor & Hyde 2003), *P. elongatum* J.L. Chen & Tzean (Chen & Tzean 1993), *P. duartei* Mercado (Mercado-Sierra 1983), *P. nilgirensis* (Subram.) M.B. Ellis (Ellis 1976), *P. rigidum* Schwein. (Schweinitz 1832), *P. etheldoidgeae* Crous & al. (Crous & al. 1995), and *P. furcatum* R. Sharma & Panwar (Sharma & Panwar 1986). However, two of these species should be re-evaluated to confirm their affiliation with *Podosporium*: *P. etheldoidgeae* has polytretic, intercalary conidiogenous cells; *P. furcatum* has euseptate and distoseptate conidia.

Podosporium simile has obclavate conidia similar to *P. elongatum* and *P. nilgirensis*. However, *P. elongatum* differs by its bigger ($62\text{--}188 \times 6\text{--}10 \mu\text{m}$) conidia with 8–21-eusepta (Chen & Tzean 1993), and *P. nilgirensis* differs by its smaller ($32\text{--}50 \times 7\text{--}9 \mu\text{m}$) conidia with only 4–6 eusepta (Ellis 1976).

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